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Blockchain in Healthcare

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10 Blockchain in Healthcare

A Smart and Hierarchical Decentralized Tracing Application in Healthcare by Blockchain

M. Kumar, Himanshu Dubey, and K. Kumar

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10.1 INTRODUCTION

Blockchain technology supports a distributed and hybrid milieu with no requirement for a principal authority. While scripting, a keen focus toward the blockchain has centered on cryptocurrency, mainly “Bitcoin2” and the impact of blockchain is expected to have on the financial sector. This result is directed to the well-known consultancy, “labeling” it as one of three skills that will transform the fiscal services world.

Notwithstanding the attention on fiscal facilities, there are numerous other zones for movement in real estate, supply chain management, and healthcare. Healthcare is the major for commotion due to the diversity of glitches in the business which can be resolved by blockchain through its immutability, fraud prevention, and capability of sharing data between hospitals without requiring trust.

The existing complexity within the current healthcare system is recorded in Table 10.1. A main complexity, as known by Frost & Sullivan, to tag the health apparatus along with the operable ID and in amalgamating belief in maneuvering recognition and tracing. When a maneuver, such as a distillation pump, is revealed to consume crashed, the chasing of the maneuver can disclose the basis of the complexity and stop needless repurchasing in the case of a missing maneuver. A robust belief set up created nearby the recognition of remedial maneuver is possible to decrease

TABLE 10.1
Existing Complexity within the Current Healthcare Industry

Domain Issue	Description
Healthcare Data Interchange	Information must be clear between healthcare workers and required third parties, brokers, and patients, while constantly observing data protection in the healthcare system.
Nationwide Coordination	Consuming a sole standard for patient information interchange allows ease of transient information between healthcare workers, which request systems regularly do not offer.
Medical device tracking	Healthcare maneuver tracing from sources chain to discharging permits for rapid recovery of devices, anticipation in needless purchasing, etc.
Drug tracking	In the context of healthcare, blockchain provides the competence to trace the chain of care from supply chain to patients and also permits the rapid detection, and restriction, of fake medicines.

these coercions. The information approximates that only 20% to 30% of health maneuvers are associated within infirmaries, due to safety, and secrecy complexity. In the curative industry, blockchain can relieve the cumulative jeopardies about fake and non-approved drugs. With the maneuver tracing, it is workable to explain “smart contracts” for painkillers and then classify pill ampules, with unified “GPS” and chain-of-custody classification.

In clinical tests, blockchain can be utilized to stun the complexity of fake outcomes and remove information, which does not keep the bias of authors or backing source’s purpose. This will apply truthfulness in clinical tests.

10.2 LITERATURE REVIEW

In the paper [1] the authors discuss the Internet of Things (IoT) and also the advances in IoT which leads to the new term Internet of Computing (IoC). It also informs about the combined use of the IoT and IoC in the many sensor technologies in the upcoming times.

In the paper [2] the authors discussed the use of cryptography and steganography techniques for security purpose in the IoT. In this paper the elliptic variety galois cryptography protocol is used in which a cryptographic technique is used to encode the secret information and then uses the matrix XOR coding steganography technique to embed the secret message; then the adaptation firefly algorithm is used to optimize the canopy blocks among the images, and the information which is hidden is recovered and decrypted.

In the paper [3] the authors discussed about the use of cyber security in the distributed and parallel computing system and use of the blockchain in the cyber security system which can enhance the security of the information system.

In the paper [4] the authors suggest a blockchain framework in medical which includes all shareholders in the healthcare system to examine prospects and contests by giving a unified blockchain design.

In the paper [5] the authors elaborate the combination of data, network, and blockchain technology in healthcare. Healthcare data have become an imperative element in this sector. There is a need for the secure and safe transmission of medical data among the organization. The big challenge is to collect the information about patient diseases which has become essential to restrict the pandemic in the world. There are numerous ways of doing this, although it is not possible to obtain complete and temporal information at a given time. To bring transparency between hospitals around the world, there is a need to share the data directly across the world. This can only be done via technology which includes a combination of IoT networks and blockchain which is decentralized in system and has the capability to store the data in a distributed manner.

In the paper [6] the authors review the use of blockchain technology in the healthcare system. The use of this technique is increasing day by day and there are various areas within the healthcare system where blockchain technique could make a huge impact which could enhance our healthcare system.

In the paper [7] the authors proposed the programmable blockchain method to overcome the challenges in the healthcare system such as the communication gap, inefficient clinical report delivery, and poor management of health records. It can also provide the evaluation metrics to assess the blockchain-based distributed applications with respect to their feasibility, capabilities, and healthcare system compliance.

In the paper [8] the authors proposed to upsurge the consideration of blockchain technology as a data store and to endorse a systematic method for bulky software systems. In this paper, authors classify the mutual layers of a typical software system with data stores and conceptualize each layer in blockchain terms. The authors also inspect the location and movement of information in “blockchain-based” operations. Finally, the authors scrutinize the information administration complexity in blockchain with relationship assurance in terms of privacy and security.

In the paper [9] the authors discuss the potential usage of blockchain technology in administration, with a summary of the latest advances in the arena of blockchain technology as an instance of methodical maturity and administration. The association between Individual(s), Right(s) and Entity(s) in a hospital system is the foundation for the description of mandatory functionality, assuming the intricacy between these three fundamentals: uniqueness of an individual, lawful variety in objects. The paper investigates certain principles of good administration, which include transparency, accountability, security, and regulation, made possible by blockchain technology. It is concluded that the method is not adequate for operation in administration at the moment.

In the paper [10] the authors describes the blockchain and its dispersion looks to be changeable for dissimilar industries. The objective of this study is to discover the blockchain technology dispersal in various industries through a mixture of academic literature and social media.

10.3 PROPOSED FRAMEWORK

The health-tracking structure has become vital for delivering health reports within a definite time. The health-tracking system can track the health of human beings with three-tier architecture through which people interconnect to the IoT network and hospital management system that contains the artificial intelligent system to attain

the information based on the identity of people that is needed to create the chain of a particular patient and detect the health issues based on patient history with a phenomenon of blockchain technology where it is needed to get the data request of the patient and transfer that information to all existing nodes in the system for cloning the information and storing the information in a distributed manner. The distributed information helps the availability of information at any place from where want to access. Blockchain architecture recommends a decentralized system as an environment of distributed node that stores information of a particular person and provides in the chain whenever required. The benefit of the architecture is distributed in nature since the failure of a single node does not lean to a failure of all node information, while the crashing of a single node will not crash the whole system. In this paper, the authors describe a tracking system of a disease and how a pandemic can be restricted by transparency tracing via blockchain by inclusion of another learning concept called machine learning that helps to evaluate the pattern.

The disease influenced patient required to be ascertained as timely as possible and the analysis of a sizable amount of people can be achieved at their inland since it is spread from human to human and necessary to protect individual. There is a prerequisite for a block system that formed a system for taking patient data to test and analyze at their inland and can deliver the outcomes instantly. There are numerous techniques existing that are useless in the particular, which carries us about to improve a domain-specific study for evolving a system. There are numerous health expert systems existing to assess and foresee ailments based on the information delivered by the patient (Figure 10.1).

The framework in the above figure shows how to develop an expert system based on blockchain technology, in which a chain of connected nodes carries the request from the users and distributes it in a distributed environment where each node contains the copy data for validation and verification purposes. This helps in tracking the health of a patient whose history is maintained in a distributed database. In this way, a health-tracking system is formed for tracking the health of patients.

Hence, this system is based on blockchain and is known as a healthcare tracking system for tracking the data of patients who are under the control of a particular doctor, but the patient data would be distributed among several authentic labs over the world.

10.4 DATA FLOW ANALYSIS IN BLOCKCHAIN

In which the data flow in architecture of blockchain is shown via the hospitals' system in an associated network of hospitals worldwide is shown, which consists of events that are linked among them and functioned, which usually shows the flow of the data in the network of a hospital through the blockchain for transparency and tracing about the pandemics.

Figure 10.2 shows the diagram of blockchain in hospitals, in which the flow of the events through the system in hospitals is shown which consists of events that are associated among them and are worked and linked in the hospitals, which generally shows the flow of the data in the hospitals through the various processes. As the data stored in the blockchain is immutable. the path taken by the blockchain for data flow from generation to the end is negligible. For a better flow diagram, the necessary

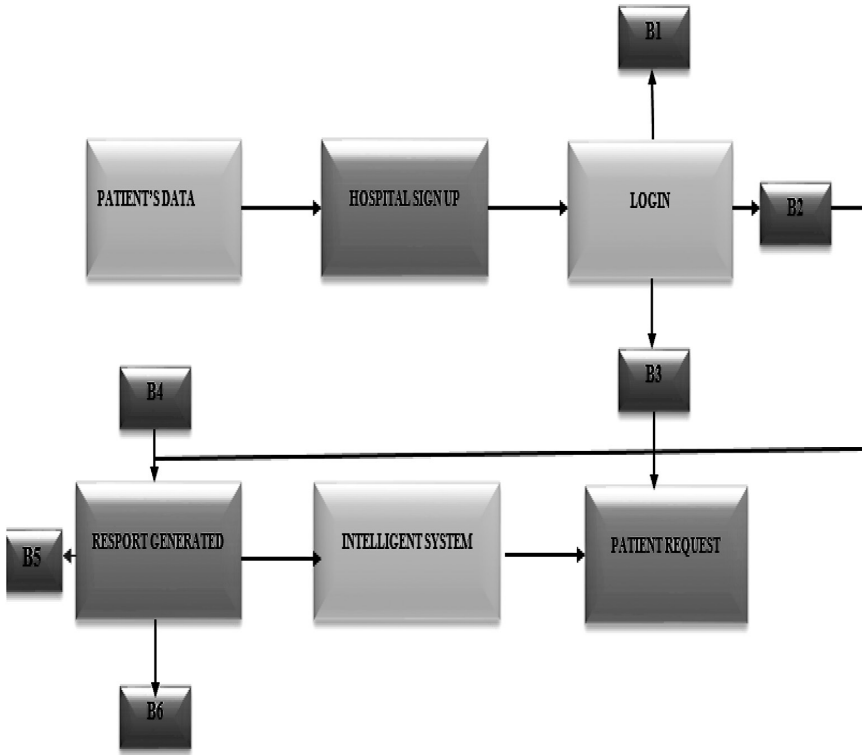


FIGURE 10.1 Proposed framework.

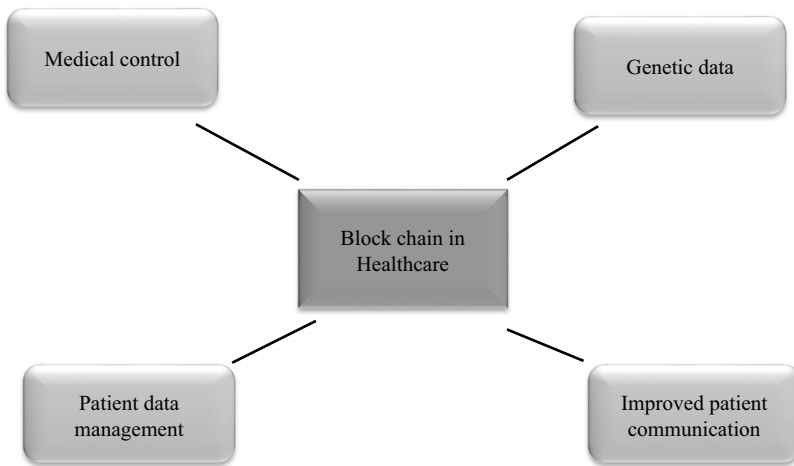


FIGURE 10.2 Blockchains in healthcare.

features of blockchain are present. This refers to the flow of the digital data acquisition in the internal and external databases for the production data transfer. The actual databases after preprocessing and the feedback database are not that much necessary, because the infrastructure in both scenarios is the same, so it can be assumed or neglected. These healthcare technologies are useful and helpful in the blockchain technical production. While looking at the production in the digitization, the chain of an events approach is as follows:

- (1) System
- (2) Patient data
- (3) Processing
- (4) Record.

A healthcare system that is based on the blockchain can safeguard data, lessen fraud, and streamline processes, waste, and misuse, while concurrently increasing trust and responsibility. A hospital that is based on the blockchain model, independent businesses and hospitals divide assets over a dispersed ledger, safeguarded by using cryptography. For protecting sensitive citizen and hospital data, the structure given above is used that will also eliminate the single point failures. A hospital that is based on the blockchain has the capability to resolve provision main points and allow the following advantages:

- (1) Preserving the patients' and hospitals' data
- (2) Diminution of patient-concerted processes
- (3) Attenuation of immoderate costs related to managing liability and hospitality
- (4) Diminishing abuse and dishonesty about the data
- (5) Enhancing belief in the online healthcare system
- (6) Building up faith between the healthcare workers and patients
- (7) Enhancing efficiency
- (8) Safeguarding sensitive and significant data
- (9) Maintaining patient indices.

The healthcare workers' distribution ledger style can be grasped to assist a cluster of hospitals, which includes the sign up and login, identification management, healthcare, voting, supply chain management, and land registration. There are numerous hospitals that join the battle to process statutory legislation and begin pilot projects that are centered on blockchain technology. It can leverage blockchain technology to supply process optimization and data security. Hospitals and authority systems have a complex and ever-evolving issue of identity and security. For solving the issues related to the data authenticity and transparency system and identity, blockchain is used because it has exceptional utility to provide the solutions. There are many benefits in using blockchain technologies to improve healthcare systems:

- (1) Medical devices will be advanced with a high level of security
- (2) The data of patients in hospitals are transparent so they can be easily tracked
- (3) Transactions done by hospitals are faster by using blockchain
- (4) The chances of hacking threats are also reduced to a larger extent

- (5) There is no need to pay centralized services because blockchain has decentralized platforms
- (6) Different levels of accessibility are also offered by the organization's blockchain technology
- (7) Interoperability
- (8) Affirm adjudication
- (9) Supply chain management.

10.5 RESEARCH IMPLICATIONS

In the healthcare sector, blockchain technology has emerged as a tremendous potential to develop an approach which is more patient-centric and can connect different systems to trace diseases quickly by getting more precise results in electronic healthcare records. This chapter has discussed an advanced research and analysis in the context of healthcare. The main objective is to get information about existing systems and their limitations and to seek solutions toward blockchain technology in the healthcare sector. The analysis approach consists of collection of data and its properties with a bibliometric review. The conclusion specifies that blockchain technology research in healthcare is cumulative and it is typically consumed for sharing of information, to trace health across the world. Hence, blockchain is playing a vital role in developing a system in the context of healthcare which distributes information about diseases and manages the health of patients by keeping all their records.

- Future work includes the integration of multiple hospital data for early diagnosis of disease.
- To work on a combination of a decentralized system and a resilient distributed data approach with cloud computing to invent a health-tracking system.

10.6 APPLICATION WORK

The research gaps encountered by researchers for positioning of projected and advanced administration system in healthcare are described as:

- (1) The upward and huge investigation conceded in this area with parallel methods keep out the authors' new approach.
- (2) The lack of accessibility of papers means for investigators that definite studies are absent from the research paper as there are present some articulators that cannot be immediately obtainable.
- (3) The rising and enormous request of research in the information security field makes it likely that the authors will leave out some of the principal research from an interconnected study directed by investigators.

10.7 CONCLUSION AND FUTURE SCOPE

In recent years, blockchain technology has become very popular in various contexts, especially due to the attractiveness of cryptocurrencies. In the healthcare sector, blockchain technology has emerged as a tremendous potential to develop an approach

which is more patient-centric and can connect different systems to trace diseases quickly by getting more precise results of electronic healthcare records. This chapter has discussed the advanced research and analysis in the field of healthcare. The chapter discussed how existing systems work, and their limitations. The chapter also discussed the solutions in the healthcare sector using blockchain technology.

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